



PATENT
Atty. Dkt. No. AMAT/4215.Y1/CMP/CMP/RKK

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: §
Sun, et al. §

Serial No.: 09/645,690 § Group Art Unit: 1746
§
Confirmation No.: 4428 § Examiner: Gentle E. Winter
§
Filed: August 24, 2000 §
§
For: Cu Cmp Polishing Pad
Cleaning §
§

MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

CERTIFICATE OF MAILING

37 CFR 1.8

I hereby certify that this correspondence is being deposited on September 2, 2004 with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

9/2/04

Date

Kathleen M. Zell

Signature

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1746 dated January 2, 2004, finally rejecting claims 1-18, 26-31, and 33. Please charge the fee of \$330.00 for filing this brief to Deposit Account No. 20-0782/AMAT/4215.Y1/KMT. Three copies of this brief are submitted for use by the Board.

Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

Related Appeals and Interferences

Applicants assert that no other appeals or interferences are known to the Applicants, the Applicants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-18, 26-31, and 33 are pending in the application. Claims 1-25 were originally presented in the application. Method claims 1-18 were elected in a Response to a Restriction Requirement Dated June 18, 2002. Claims 26-33 were added by amendment. Claims 19-25 and 32 have been canceled.

Claims 1-18, 26-31, and 33 stand rejected in view of several references as discussed below. The rejection of claims 1-18, 26-31, and 33 based on the cited references is appealed. The pending claims are shown in the attached Appendix.

Status of Amendments

Claims 4-5, 10-12, 15-16, 26, 28, have been amended before a Final Office Action dated January 2, 2004. Amendments submitted after the Final Office Action were not entered by the Examiner, as the Examiner deemed the amendment not to place the application in better form for appeal in an Advisory Action dated April 9, 2004. Arguments presented after the Final Office Action were not accepted by the Examiner.

Applicants have further submitted amendment to claim 12 in a separate paper on September 2, 2004 to correct a typographical error and assert that there is no new matter. The proposed amendment has not been entered and is not in the Appendix.

Summary of Invention

Aspects of the invention provides a method of cleaning a polishing pad surface to prevent or subsequently reduce pad glazing stemming from conducting CMP on a wafer surface containing Cu or Cu alloy, and an apparatus for conducting a CMP on a wafer surface containing Cu or Cu alloy with significantly reduced pad glazing (page 3, lines 22-26).

Conventional pad cleaning techniques employ rinsing a polishing pad following

CMP since pad cleaning must be performed frequently to clean residues on the polishing pad after polishing and remove compacted slurry from the polishing pad, wherein a substrate mounting head for mounting a substrate is removed from contact with the polishing pad, the supply of a slurry from a slurry/rinse arm is turned off, and a rinse fluid such as deionized water is supplied via the slurry/rinse arm (page 2, lines 21-26). Rinsing the polishing pad after a CMP process is ineffective to remove metal by-products stuck to the polishing pad and causing a colored glaze on the polishing pad after CMP of metal films (page 2, lines 26-28, and page 3, lines 3-8). Conventional approaches to remedy pad glazing include the use of brushes or diamond disk located on a conditioning head to effect pad conditioning during or after CMP, rather than a cleaning solution (page 2, lines 15-20, and page 3, lines 7-16).

In one aspect, the invention provides a method of cleaning a polishing pad surface subsequent to chemical-mechanical polishing a wafer surface containing copper (Cu) or a Cu-based alloy, the method comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0 and water (page 5, lines 26-32, and page 6, lines 1-2). Subsequent to cleaning, the polishing pad surface is rinsed with water to remove the cleaning solution prior to initiating CMP on a subsequent wafer (page 6, lines 2-4).

Another aspect of the invention is a method comprising the sequential steps of conducting chemical-mechanical polishing (CMP) on a first wafer surface containing copper or a Cu alloy on a surface of a polishing pad, applying to the polishing pad surface a cleaning composition, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface, and conducting CMP on a second wafer (page 4, lines 6-14).

In another aspect, the invention provides an apparatus 31 for conducting CMP on a wafer surface containing copper or a Cu alloy, the apparatus comprising a platen 15, a polishing pad 17 mounted on the platen, a first dispenser 27 adapted to dispense a cleaning composition on a surface of the polishing pad, and a source 33 of the cleaning solution coupled to the first dispenser (page 4, lines 14-21).

Issues Presented

1. Whether the Examiner erred in rejecting claims 1-3, 8, 12-14, 16, 26, 27 and 33 under 35U.S.C. §103(a) as being obvious over United States Patent No. 5,981,454 to *Small* and United States Patent No. 6,352,595 to *Svirchevski et al.*
2. Whether the Examiner erred in rejecting claims 12-14 and 16 under 35U.S.C. §103(a) as being obvious over *Small* and *Svirchevski et al.*
3. Whether the Examiner erred in rejecting claims 4-7, 9-11, and 28-31 under 35U.S.C. §103(a) as being obvious over *Small* and United States Patent No. 6,280,299 to *Kennedy et al.*
4. Whether the Examiner erred in rejecting claims 15, 17, and 18 under 35U.S.C. §103(a) as being obvious over *Small*, *Svirchevski et al.*, and *Kennedy et al.*

Grouping of Claims

The rejected claims have been grouped together in the Final Rejection. The first argument relates to the first issue for claims 1-3, 8, and 33, with claim 1 being representative of this grouping.

The second argument relates to the first issue for claims 12-14 and 16, with claim 12 being representative of this grouping.

The third argument relates to the first issue for claims 26 and 27, with claim 26 being representative of this grouping.

The fourth argument relates to the second issue for claims 12-14 and 16, with claim 12 being representative of this grouping.

The fifth argument relates to the third issue for dependent claims 4-7 and 9-11, with independent claim 1 being representative of this grouping.

The sixth argument relates to the third issue for dependent claims 28-31, with independent claim 26 being representative of this grouping.

The seventh argument relates to the fourth issue for dependent claims 15, 17, and 18, with independent claim 12 being representative of this grouping.

THE REFERENCES

The Examiner relies on the following references:

Author	Reference number	Publication Date
<i>Small</i>	US Patent No. 5,981,454	November 9, 1999
<i>Svirchevski et al.</i>	US Patent No. 6,352,595	March 5, 1999
<i>Kennedy et al.</i>	US Patent No. 6,280,299	August 28, 2001

BRIEF DESCRIPTION OF THE REFERENCES

United States Patent No. 5,981,454 to *Small* teaches a method and composition for cleaning a wafer after an etch process and the composition can also be used for polishing a wafer surface during chemical mechanical planarization (CMP). *Small* discloses a post clean treatment (PCT) composition including about 1% to about 25% by weight of an organic acid and a buffering amount of hydroxylamine to a final pH of between about 3.5 and about 7. (See, columns 14-16.) *Small* also teaches a two step process of cleaning a wafer through an ashing step 12 and/or a wet chemistry step 14 to clean photoresist or etch residues, and afterward rinsing the cleaned wafer through a rinsing step 22 using the post clean treatment composition (PCT) of *Small* in a bath or a beaker (container) to rinse and remove chemical residues from the wafer having metal or dielectric surfaces (See, column 1, lines 29-37 and 45-52, column 3, lines 40-51, and Figure 2). The rinsing step 22 of *Small* is provided to replace a carbonated water rinse step 16, an isopropyl alcohol rinse step 18, or an N-methyl pyrrolidone rinse step 20. (See, Figure 2.) The immersion duration disclosed in *Small* is from 30 min (Example 2) to 24 hours (Example 3).

Small also summarizes that the Post Clean Treatment solution of *Small* can effectively rinse traces of amine and basic chemistries from wafer surfaces, thus eliminating the corrosion possibility of amine based chemistries and excess OH⁻ ions from a DI water rinse. The Post Clean Treatment solution can be used after pre-diffusion cleans, pre-implantion cleans and pre-deposition cleans under essentially the same conditions. The solution can also be used for post chemical mechanical polishing cleaning, and as a chemical mechanical polishing slurry for copper substrates

United States Patent No. 6,352,595 to *Svirchevski et al.* teaches a method of

cleaning a polishing pad using a composition of hydrogen chloride (HCl) and water when the wafer surface is copper, or ammonium hydroxide (NH₄OH) and water, when the wafer surface is oxide.

United States Patent No. 6,280,299 to *Kennedy et al.* teaches a chemical mechanical polishing apparatus for delivering one or more polishing slurries and one or more rinse agents to a substrate surface or a polishing pad surface. (See, *Kennedy*, abstract.) *Kennedy et al.* also teaches that a single arm may include multiple slurry delivery nozzles and multiple rinse agent nozzles. (See, *Kennedy*, column 3, line 62 through column 4, line 14.)

ARGUMENT

It is submitted in the following arguments that a proper interpretation of *Small*, *Svirchevski et al.*, and *Kennedy et al.* as proposed by the Examiner in the Final Office Action, alone or in combination, does not teach, show, or suggest the subject matter recited in the Applicants' claims.

I. ***35 U.S.C. §103 - Small in view of Svirchevski et al.***

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 1-3, 8, and 33 over *Small* in view of *Svirchevski et al.* The combination of *Samll* and *Svirchevski et al.* does not teach, show, or suggest all of the limitations recited by claims 1-3, 8, and 33.

Small teaches use of a post clean treatment (PCT) composition for rinsing a wafer in order to neutralize the pH of an amine solution when rinsing a wafer with the amine solution during post etch clean. In addition, *Small* teaches that the PCT composition can also be used as a polishing slurry during chemical mechanical polishing (CMP) a wafer. *Svirchevski et al.* teaches a composition for cleaning a polishing pad after a chemical mechanical polishing process in order to clean residues on the polishing pad and remove any residual polishing slurry from the polishing pad. The combination of *Small* and *Svirchevski et al.* fails to suggest that the PCT composition of *Small* may be used to clean a polishing pad after a polishing process.

The burden for establishing a prima facie case of obviousness falls on the Examiner. See, *MPEP* §2142. A basic requirement of establishing a prima facie case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the teaching of the references. See, *MPEP* §2143.

The Applicants assert that the Examiner has failed to establish a prima facie case because the combination of *Small* and *Svirchevski et al.* does not teach or suggest cleaning a polishing pad surface comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claim 1, and claims dependent therefrom.

Small discloses a post clean treatment composition including about 1% to about 25% by weight of an organic acid and a buffering amount of hydroxylamine to a final pH of between about 3.5 and about 7. (See, columns 14-16.) In contrast to the Examiner's statement, the hydroxylamine concentration is not explicitly disclosed and it is not clear what is the percentage of hydroxylamine used by *Small* with regard to the buffering amount of hydroxylamine. In addition, *Small* does not teach, show, or suggest any organic compound containing one or more amide groups.

Small states that, during post-etch cleaning of a wafer, amines react with water to form hydroxide groups which attack and etch the metal surface of a wafer. Thus, *Small* proposes using the post clean treatment (PCT) composition to neutralize the pH of amine impurity with specific acids without destroying the metal oxide coating on the wafer (See, column 4, lines 7-30) and prevent the corrosion of metal surface on a wafer surface, wherein the corrosion is caused by low concentrations (3-20%) of amines in water rinses during cleaning of the wafer. Figure 3 of *Small* shows the corrosion of aluminum metal on a wafer under various concentrations of amines which remain in a rinse solution. Thus, *Small* teaches away from amines in water rinses for cleaning a wafer and proposes specific types of acids to neutralize the pH of the wafer surface because other types of acids do not work. Since Figure 3 shows the harmful corrosion effect of amines solution at various concentrations on a wafer during wafer claning, the

Examiner has mistakenly taken a concentration (3-20%) of amines in water rinses as disclosed in *Small* as the post clean treatment (PCT) composition of *Small*.

In addition, *Small* does not teach, show, or suggest applying to a polishing pad surface a cleaning composition. *Svirchevski et al.* does not teach a cleaning composition, including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water. Thus, the combination of *Small* and *Svirchevski et al.* does not teach, show, or suggest applying to a polishing pad surface a cleaning composition, the cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claims 1-3, 8, and 33.

Further, the PCT composition of *Small* for rinsing a wafer or polishing a wafer can not be combined with the method and composition of *Svirchevski et al.* for cleaning a polishing pad and there is no suggestion or motivation in both references to combine the teachings. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

The Examiner has expanded upon the teaching of *Small* and *Svirchevski et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is clearly evident that *Small* never contemplated applying the composition for a polishing pad cleaning technique.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a

suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. As known in the art, in *Svirchevski et al.*, and in the background of the instant patent application, pad cleaning technology must be performed frequently to clean residues on the polishing pad after polishing and to remove slurry from the polishing pad using a specific pad cleaning composition. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Svirchevski et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

Therefore, the combination of *Small* and *Svirchevski et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claims 1-3, 8, and 33.

II. 35 U.S.C. §103 - *Small* in view of *Svirchevski et al.*

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 12-14 and 16 over *Small* in view of *Svirchevski et al.* The combination of *Samll* and *Svirchevski et al.* does not teach, show, or suggest all of the limitations recited by claims 12-14 and 16.

Small and *Svirchevski et al.* have been discussed above.

The combination of *Small* and *Svirchevski et al.* fails to suggest that the PCT

composition of *Small* may be used to clean a polishing pad after conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy. The burden for establishing a *prima facie* case of obviousness falls on the Examiner. See, MPEP §2142. A basic requirement of establishing a *prima facie* case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the teaching of the references. See, MPEP §2143. The Applicants assert that the Examiner has failed to establish a *prima facie* case because the combination of *Samll* and *Svirchevski et al.* does not teach or suggest a method comprising the sequential steps: conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy, applying to a polishing pad a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing pad surface, conducting CMP on a second wafer, and repeating the sequential steps, as recited in claim 12 and claims dependent therefrom.

In contrast to the Examiner's statement, the hydroxylamine concentration is not explicitly disclosed and it is not clear what is the percentage of hydroxylamine used by *Small* with regard to the buffering amount of hydroxylamine. Figure 3 of *Small* shows the corrosion of aluminum metal on a wafer under various concentrations of amines which remained in a rinse solution. The Examiner has mistakenly taken a concentration range of amines in water rinses as disclosed in Figure 3 of *Small* as the post clean treatment (PCT) composition of *Small*. In fact, *Small* teaches away from low concentrations of amines in water rinses for cleaning a wafer and proposes specific types of acids to neutralize the pH of the wafer surface because other types of acids do not work. Thus, *Small* does not teach, show, or suggest applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

In addition, *Svirchevski et al.* does not teach a cleaning composition including

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

Further, the PCT composition of *Small* for rinsing a wafer or polishing a wafer can not be combined with the method and composition of *Svirchevski et al.* for cleaning a polishing pad and there is no suggestion or motivation in both references to combine the teachings. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

The Examiner has expanded upon the teaching of *Small* and *Svirchevski et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is clearly evident that *Small* never contemplated applying the composition for a polishing pad cleaning technique.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and

material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. As known in the art, in *Svirchevski et al.*, and in the background of the instant patent application, pad cleaning technology must be performed frequently to clean residues on the polishing pad after polishing and to remove slurry from the polishing pad using a specific pad cleaning composition. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Svirchevski et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

Therefore, *Small* in view of *Svirchevski et al.*, alone or in combination, does not teach, show, or suggest a method comprising the sequential steps: conducting chemical-mechanical polishing (CMP) on a first wafer surface containing copper (Cu) or a Cu-based alloy on a surface of a polishing pad; removing the first wafer from the pad; applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water; rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface; conducting CMP on a second wafer; and repeating the steps, as recited in claims 12, 14 and 16.

III. 35 U.S.C. §103 - *Small* in view of *Svirchevski et al.*

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 26 and 27 over *Small* in view of *Svirchevski et al.* The combination of *Samll* and *Svirchevski et al.* does not teach, show, or suggest all of the limitations recited by claims 26 and 27.

Small and *Svirchevski et al.* have been discussed above.

The combination of *Small* and *Svirchevski et al.* fails to suggest that the PCT composition of *Small* may be used to clean a polishing pad after conducting chemical mechanical polishing on a first wafer surface and removing the first wafer from the polishing pad. The burden for establishing a prima facie case of obviousness falls on the Examiner. See, MPEP §2142. A basic requirement of establishing a prima facie case of obviousness is that the combination of prior art references must teach or

suggest all the claim limitations and that there must be a motivation to combine the teaching of the references. See, MPEP §2143. The Applicants assert that the Examiner has failed to establish a *prima facie* case because the combination of *Small* and *Svirchevski et al.* does not teach or suggest a method of cleaning a surface of a polishing pad comprising: conducting chemical mechanical polishing on a first wafer on the surface of a polishing pad; removing the first wafer from the polishing pad; applying to the polishing pad a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water; cleaning the polishing pad surface with the cleaning composition, as recited in claim 26 and claims dependent therefrom.

In contrast to the Examiner's statement, the hydroxylamine concentration is not explicitly disclosed and the Examiner has mistakenly taken a concentration range of amines in water rinses as disclosed in Figure 3 of *Small* as the post clean treatment (PCT) composition of *Small*. In fact, *Small* teaches away from low concentrations of amines in water rinses for cleaning a wafer and proposes specific types of acids to neutralize the pH of the wafer surface because other types of acids do not work. Thus, *Small* does not teach, show, or suggest applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

In addition, *Svirchevski et al.* does not teach a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

Further, the PCT composition of *Small* for rinsing a wafer or polishing a wafer can not be combined with the method and composition of *Svirchevski et al.* for cleaning a polishing pad and there is no suggestion or motivation in both references to combine the teachings. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

The Examiner has expanded upon the teaching of *Small* and *Svirchevski et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is clearly evident that *Small* never contemplated applying the composition for a polishing pad cleaning technique.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. As known in the art, in *Svirchevski et al.*, and in the background of the instant patent application, pad cleaning technology must be performed frequently to clean residues on the polishing pad after polishing and to remove slurry from the polishing pad using a specific pad cleaning composition. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Svirchevski et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

Therefore, *Small* in view of *Svirchevski et al.*, alone or in combination, does not

teach, show, or suggest a method of cleaning a surface of a polishing pad, comprising: conducting chemical-mechanical polishing (CMP) on a first wafer on the surface of a polishing pad; removing the first wafer from the polishing pad; applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water; rinsing the polishing pad surface with the cleaning composition, as recited in claims 26 and 27.

IV. 35 U.S.C. §103 - Small in view of Svirchevski et al.

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 12-14 and 16 over *Small* in view of *Svirchevski et al.* The combination of *Samll* and *Svirchevski et al.* does not teach, show, or suggest all of the limitations recited by claims 12-14 and 16.

Small and *Svirchevski et al.* have been discussed above.

The combination of *Small* and *Svirchevski et al.* fails to suggest that the PCT composition of *Small* may be used to clean a polishing pad after conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy. The burden for establishing a *prima facie* case of obviousness falls on the Examiner. See, *MPEP* §2142. A basic requirement of establishing a *prima facie* case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the teaching of the references. See, *MPEP* §2143. The Applicants assert that the Examiner has failed to establish a *prima facie* case because the combination of *Small* and *Svirchevski et al.* does not teach or suggest a method comprising the sequential steps: conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy, applying to a polishing pad a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing pad surface, conducting CMP on a

second wafer, and repeating the sequential steps, as recited in claim 12 and claims dependent therefrom.

In contrast to the Examiner's statement, the hydroxylamine concentration is not explicitly disclosed and the Examiner has mistakenly taken a concentration range of amines in water rinses as disclosed in Figure 3 of *Small* as the post clean treatment (PCT) composition of *Small*. In fact, *Small* teaches away from low concentrations of amines in water rinses for cleaning a wafer and proposes specific types of acids to neutralize the pH of the wafer surface because other types of acids do not work. Thus, *Small* does not teach, show, or suggest applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

In addition, *Svirchevski et al.* does not teach a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water.

Further, the PCT composition of *Small* for rinsing a wafer or polishing a wafer can not be combined with the method and composition of *Svirchevski et al.* for cleaning a polishing pad and there is no suggestion or motivation in both references to combine the teachings. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

The Examiner has expanded upon the teaching of *Small* and *Svirchevski et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, *Small* does not motivate applying the composition for a polishing pad cleaning technique.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification.

In re Fritch, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. As known in the art, in *Svirchevski et al.*, and in the background of the instant patent application, pad cleaning technology must be performed frequently to clean residues on the polishing pad after polishing and to remove slurry from the polishing pad using a specific pad cleaning composition. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Svirchevski et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

Therefore, *Small* in view of *Svirchevski et al.*, alone or in combination, does not teach, show, or suggest a method comprising the sequential steps: conducting chemical-mechanical polishing (CMP) on a first wafer surface containing copper (Cu) or a Cu-based alloy on a surface of a polishing pad; removing the first wafer from the pad; applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water; rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface; conducting CMP on a second wafer; and repeating the steps, as recited in claims 12, 14 and 16.

V. 35 U.S.C. §103 - Small in view of Kennedy et al.

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 4-7 and 9-11 over *Small* in view of *Kennedy et al.* The combination of *Small* and *Kennedy et al.* does not teach, show, or suggest all of the limitations recited by claims 4-7 and 9-11.

Small has been discussed above.

Small teaches away from low concentration of amines in water and *Small* fails to suggest or motivate that the PCT composition may be used to clean a polishing pad after a polishing process. Further, *Small* teaches using a PCT composition to rinse a wafer or polish a wafer but fails to suggest a polishing pad cleaning technique.

Kennedy et al. discloses an apparatus for polishing a wafer or cleaning a polishing pad but fails to suggest or motivate that a method of cleaning a polishing pad using the pad cleaning composition as recited in claims 1, 12, 26 and claims dependent therefrom. *Kennedy et al.* teaches a chemical mechanical polishing apparatus having multiple slurry delivery nozzles and multiple rinse agent nozzles but fails to suggest a pad cleaning composition. There is no suggestion or motivation in both references to use the PCT composition of *Small* in a polishing pad cleaning technique. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

Further, the combination of *Small* and *Kennedy et al.* fails to suggest or motivate a pad cleaning technique using the pad cleaning composition, the pH, by-products of Cu and Cu based alloy, flow rate, cleaning time, and more, as recited in claims 4-7 and 9-11. None of the references teaches a pH of a pad cleaning composition of about 8 to about 11, the organic compound of the cleaning composition interacts with by-products of the Cu and/or Cu-based alloy generated during CMP to form at least one complex that is soluble in water, and the polishing pad surface is rinsed with water to remove the at least one complex, applying the cleaning composition to a rotating polishing pad at a flow rate of about 100 to about 600 ml/min, applying the cleaning composition to the polishing pad for about 3 seconds to about 20 seconds after conducting CMP on each of a plurality to wafers having a surface comprising Cu or Cu alloy, rinsing by applying

pressurized water to the polishing pad surface for about 2 seconds to about 20 seconds, removing any surface coating materials from the wafer surface before applying the cleaning composition to the polishing pad surface, or conditioning the polishing pad surface before, during and after applying the cleaning solution.

The burden for establishing a *prima facie* case of obviousness falls on the Examiner. *See, MPEP §2142*. A basic requirement of establishing a *prima facie* case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the references. *See, MPEP §2143*.

The Applicants assert that the Examiner has failed to establish a *prima facie* case because *Small* and *Kennedy et al.*, individually or in combination, fail to teach or suggest a method of cleaning a polishing pad surface subsequent to CMP, comprising applying to the polishing pad surface a cleaning composition, the cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claim 1 and claims dependent therefrom.

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Kennedy et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

The Examiner has expanded upon the teaching of *Small* and *Kennedy et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is evident that *Small* never contemplated applying the composition for a polishing pad cleaning techniques.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v.*

Garlock, Inc., 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Therefore, the combination of *Small* and *Kennedy et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claims 1, which claims 4-7 and 9-11 are dependent from. Moreover, the combination of *Small* and *Kennedy et al.* fails to suggest or motivate additional limitations as recited in the dependent claims 4-7 and 9-11.

VI. 35 U.S.C. §103 - *Small* in view of *Kennedy et al.*

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 28-31 over *Small* in view of *Kennedy et al.* The combination of *Small* and *Kennedy et al.* does not teach, show, or suggest all of the limitations recited by claims 28-31.

Small and *Kennedy et al.* have been discussed above.

Small teaches away from low concentration of amines in water and *Small* fails to suggest or motivate that the PCT composition may be used to clean a polishing pad after a polishing process. Further, *Small* teaches using a PCT composition to rinse a

wafer or polish a wafer but fails to suggest a polishing pad cleaning technique.

There is no suggestion or motivation in both references to use the PCT composition of *Small* in a polishing pad cleaning technique. In contrast to the Examiner's statement, the Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

Further, the combination of *Small* and *Kennedy et al.* fails to suggest or motivate a pad cleaning technique using the pad cleaning composition, the pH, flow rate, cleaning time, and more, as recited in claims 28-31. None of the references teaches a pH of a pad cleaning composition of about 8 to about 11, the cleaning composition is applied to a rotating polishing pad at a flow rate of about 100 ml/min to about 600 ml/min, the cleaning composition is applied to a rotating polishing pad for about 3 seconds to about 20 seconds, or rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface.

The burden for establishing a prima facie case of obviousness falls on the Examiner. See, *MPEP* §2142. A basic requirement of establishing a prima facie case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the references. See, *MPEP* §2143.

The Applicants assert that the Examiner has failed to establish a prima facie case because *Small* and *Kennedy et al.*, individually or in combination, fail to teach or suggest a method of cleaning a surface of a polishing pad surface, comprising conducting chemical-mechanical polishing (CMP) on a first wafer on the surface of the polishing pad, removing the first wafer from the polishing pad, applying to the polishing pad surface a cleaning composition, the cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, and cleaning the polishing pad surface with the cleaning composition, as recited in claim 26 and claims dependent therefrom.

Contrary to the Examiner's statement, a solution that is for polishing a wafer may not be effective for removing compounds from a polishing pad since the surface and

material of a wafer is not the same and non-comparable as the surface and material of a polishing pad after a polishing process. Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Kennedy et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad.

The Examiner has expanded upon the teaching of *Small* and *Kennedy et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is evident that *Small* never contemplated applying the composition for a polishing pad cleaning techniques.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q. 1125, 1127, Fed. Cir. (1984).

The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Therefore, the combination of *Small* and *Kennedy et al.* does not teach, show, or suggest a method of cleaning a surface of a polishing pad surface, comprising conducting chemical-mechanical polishing (CMP) on a first wafer on the surface of the polishing pad, removing the first wafer from the polishing pad, applying to the polishing pad surface a cleaning composition, the cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or

amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, and cleaning the polishing pad surface with the cleaning composition, as recited in claim 26, which claims 28-31 are dependent from. Moreover, the combination of *Small* and *Kennedy et al.* fails to suggest or motivate additional limitations as recited in the dependent claims 28-31.

VII. 35 U.S.C. §103 - *Small in view of Svirchevski et al. and Kennedy et al.*

The Applicants respectfully disagree with the Examiner's conclusions regarding the patentability of claims 15, 17, and 18 over *Small*, *Svirchevski et al.*, and *Kennedy et al.* The combination of *Small*, *Svirchevski et al.*, and *Kennedy et al.* does not teach, show, or suggest all of the limitations recited by claims 15, 17, and 18.

Small in view of Svirchevski et al. and Kennedy et al. fails to suggest or motivate a pad cleaning technique using the pad cleaning composition, the pH, the organic compound of the cleaning composition interacts with by-products of the Cu and/or Cu-based alloy generated during CMP to form at least one complex that is soluble in water, and the at least one complex is removed during rinsing, flow rate, cleaning time, and more, as recited in claims 15, 17, and 18.

The burden for establishing a prima facie case of obviousness falls on the Examiner. See, MPEP §2142. A basic requirement of establishing a prima facie case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the references. See, MPEP §2143.

The Applicants assert that the Examiner has failed to establish a prima facie case because *Small* and *Kennedy et al.*, individually or in combination, fail to teach or suggest a method comprising the sequential steps: conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy, applying to a polishing pad a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing pad surface, conducting CMP on a second wafer, and repeating the

sequential steps, as recited in claim 12 and claims dependent therefrom.

Small, Svirchevski et al., and Kennedy et al. has been discussed above.

Small teaches away from low concentration of amines in water. Thus, the combination of *Small, Svirchevski et al., and Kennedy et al.* does not teach, show, or suggest a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claim 12 and claims dependent therefrom.

Further, *Small* fails to suggest or motivate a polishing pad cleaning technique and the use of the PCT composition of *Small* in a polishing pad cleaning technique. There is no suggestion or motivation in the three cited references to use the PCT composition of *Small* in a polishing pad cleaning technique. The Applicants assert that *Small* does not provide any motivation for combining the teachings since *Small* does not teach, show or suggest any polishing pad cleaning technique.

Therefore, although the PCT composition of *Small* can be used as a polishing slurry, it can not be combined with *Svirchevski et al.* and *Kennedy et al.* to be used as a pad cleaning solution to remove polishing residues and slurry from the polishing pad. Further, there is no suggestion or motivation to use the PCT composition of *Small* in a pad cleaning technique under the pH, the flow rate, and the cleaning duration, as claimed in claims 15, 17, and 18.

The Examiner has expanded upon the teaching of *Small, Svirchevski et al., and Kennedy et al.* by stating that the claimed method is taught by the prior art to support his conclusion of obviousness. Although *Small* teaches a post treatment cleaning composition, it is evident that *Small* never contemplated applying the composition for a polishing pad cleaning techniques.

It is impermissible to use the claims as a framework from which to choose among individual references to recreate the claimed invention. *W. L. Gore Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 312 (1983). Moreover, the mere fact that a prior art structure could be modified to produce the claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783, Fed. Cir. (1992); *In re Gordon*, 221 U.S.P.Q.

1125, 1127, Fed. Cir. (1984).

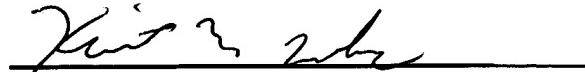
The rules applicable for combining references provide that there must be a suggestion from within the references to make the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q. 2d 1434, 1438 (Fed. Cir. 1988)., *In re Fine*, 5 U.S.P.Q. 2d at 1599. Additionally, MPEP § 2141.03 requires the Examiner to consider the prior art in its entirety. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention". MPEP §2141.03, *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Therefore, the combination of *Small, Svirchevski et al.*, and *Kennedy et al.* does not teach, show, or suggest a method comprising the sequential steps: conducting chemical mechanical polishing on a first wafer surface containing copper or a copper-based alloy, applying to a polishing pad a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing pad surface, conducting CMP on a second wafer, and repeating the sequential steps, as recited in claim 12, which claims 15, 17, and 18 are dependent from. Moreover, the combination of *Small, Svirchevski et al.*, and *Kennedy et al.* fails to suggest or motivate additional limitations as recited in the dependent claims 15, 17, and 18.

Conclusion

For the reasons advanced above, Applicants respectfully urge that the rejections of claims 1-18, 26-31, and 33 as being obvious under 35 U.S.C. §103 are improper. Reversal of the rejections in this appeal is respectfully requested.

Respectfully submitted,



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APPENDIX

1. (Original) A method of cleaning a polishing pad surface subsequent to chemical-mechanical polishing (CMP) a wafer surface containing copper (Cu) or a Cu-based alloy, the method comprising applying to the polishing pad surface a cleaning composition comprising:

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0; and

water.

2. (Original) The method according to claim 1, wherein the composition is a solution comprising:

ethylenediamine;

an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide; and
the remainder deionized water.

3. (Original) The method according to claim 1, wherein the composition is a solution consisting essentially of the organic compound, the acid or base and deionized water.

4. (Previously Presented) The method according to claim 1, wherein the composition is a solution having a pH of about 8 to about 11.

5. (Previously Presented) The method according to claim 2, wherein the organic compound of the cleaning composition interacts with by-products of the Cu and/or Cu-based alloy generated during CMP to form at least one complex that is soluble in water, and the polishing pad surface is rinsed with water to remove the at least one complex.

6. (Original) The method according to claim 4, comprising applying the solution to a rotating polishing pad at a flow rate of about 100 to about 600 ml/min

7. (Original) The method according to claim 6, comprising applying the solution to the polishing pad for about 3 seconds to about 20 seconds after conducting CMP on each of a plurality to wafers having a surface comprising Cu or Cu alloy.

8. (Original) The method according to claim 1 further comprising rinsing the polishing pad surface with water to remove any cleaning solution from the polishing pad surface, after applying the solution and prior to conducting CMP on a subsequent wafer.

9. (Original) The method according to claim 8, comprising rinsing by applying pressurized water to the polishing pad surface for about 2 seconds to about 20 seconds.

10. (Previously Presented) The method according to claim 1, further comprising removing any surface coating materials from the wafer surface before applying the cleaning composition to the polishing pad surface.

11. (Previously Presented) The method according to claim 1, comprising conditioning the polishing pad surface before, during and after applying the cleaning solution.

12. (Previously Presented) A method comprising the sequential steps:

(a) conducting chemical-mechanical polishing (CMP) on a first wafer surface of a first wafer containing copper (Cu) or a Cu-based alloy on a surface of a polishing pad;

(b) removing the first wafer from the pad;

(c) applying to the polishing pad surface a cleaning composition comprising:

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount such that the composition has a pH of about 5.0

to about 12.0; and

water;

- (d) rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface;
- (e) conducting CMP on a second wafer; and
- (f) repeating steps (b) through (e).

13. (Original) The method according to claim 12, wherein the composition is a solution comprising:

ethylenediamine;

an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide; and
the remainder deionized water.

14. (Original) The method according to claim 12, wherein the composition is a solution consisting essentially of the organic compound, the acid or base and deionized water.

15. (Previously Presented) The method according to claim 12, wherein the composition is a solution having a pH of about 8 to about 11.

16. (Previously Presented) The method according to claim 12, wherein the organic compound of the cleaning composition interacts with by-products of the Cu and/or Cu-based alloy generated during CMP to form at least one complex that is soluble in water, and the at least one complex is removed during rinsing.

17. (Original) The method according to claim 15, comprising applying the solution to a rotating polishing pad at a flow rate of about 100 to about 600 ml/min.

18. (Original) The method according to claim 17, comprising applying the

composition to the rotating polishing pad for about 3 seconds to about 20 seconds.

19-25. (Cancelled)

26. (Previously Presented) A method of cleaning a surface of a polishing pad, comprising:

conducting chemical-mechanical polishing (CMP) on a first wafer on the surface of the polishing pad;

removing the first wafer from the polishing pad;

applying to the polishing pad surface a cleaning composition, wherein the cleaning composition further comprises:

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0; and

water; and

cleaning the polishing pad surface with the cleaning composition.

27. (Previously Presented) The method according to claim 26, wherein the cleaning composition is a solution comprising:

ethylenediamine;

an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide; and

the remainder deionized water.

28. (Previously Presented) The method according to claim 26, wherein the cleaning composition is a solution having a pH of about 8 to about 11.

29. (Previously Presented) The method according to claim 26, wherein the cleaning composition is applied to a rotating polishing pad at a flow rate of about 100

ml/min to about 600 ml/min.

30. (Previously Presented) The method according to claim 26, wherein the cleaning composition is applied to a rotating polishing pad for about 3 seconds to about 20 seconds.

31. (Previously Presented) The method according to claim 26, further comprising rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface.

32. (Cancelled)

33. (Previously Presented) The method according to claim 2, further comprising: rinsing the polishing pad surface with water.